more elevated regions. On the other hand, over the more rugged portions of the country, places that rise quite high above their surroundings are subject to more frequent low ceilings.

For the area as a whole, it may be said that clouds lower than 1,000 feet (300 meters) occur on an average two or three times as often in winter as in summer, and probably twice as often at night and early morning as in the afternoon. They are generally rare on summer afternoons, except as they occur in thunderstorms. From meager statistics available, an approximation may be made that over the eastern portion of the area, a condition of low clouds, or of dense fogs, or heavy rains or snows, is recorded as occurring some time within the 24 hours on probably 20 to 30 per cent of the days in winter, while in summer the frequency may be about half that amount. Over the western portion, this frequency dwindles to perhaps half those figures for the western fringe of the area, possible even less for the extreme southwestern portion. If we consider only those days on which unfavorable conditions persisted throughout the day, the number will diminish to not more than two or three days a month in the colder season, and to practically none in the summer months, even over the least-favored sections in the east.

Visibility is better in summer than in winter, and better in the afternoon than at night or morning, probably averaging poorest in the early morning daylight hours when fogs and haze abound. Over the eastern portion of the area, visibility less than a third of a mile (0.5 kilometer) occurs on about 6 to 8 per cent of the days on winter mornings, and about 3 per cent of the days on summer mornings; on about 4 to 6 per cent of the days on winter afternoons, and 1 to 2 per cent of the summer afternoons. Visibility greater than three miles (5 kilometers) prevails during about 70 to 85 per cent of the time. Over western sections, statistics if available would show a decidedly more favorable condition.

ROCKY MOUNTAIN STATES

By HARRY M. HIGHTMAN

[Weather Bureau Airport, Salt Lake City, Utah]

Ceiling and visibility are perhaps of more importance to aviators in the Rocky Mountain region than in any other part of the country, owing to the fact that airways must traverse regions of great variations in elevation. Airplanes traversing a course over this region must pass over wide expanses of rough broken country, uninhabited desert areas, high mountain ranges, sometimes rising abruptly 4,000 feet (1,200 meters) or more above the general surface level, or through mountain passes, often narrow, with mountain peaks towering above in the near vicinity. Thus ceilings and visibilities that would be considered ample for flights in other parts of the country could not be considered at all for flights in this region.

On account of the great variation in surface elevations along the airways in this region, ceiling heights are very variable, and a determination of the average height along an airway would be of little value. However, it may be stated that the average height of ceilings in the Rocky Mountain region is greater than the average height in other parts of the country. At Salt Lake City, for example, it has been found that ceilings are seldom low enough to measure by means of a ceiling light, or ceiling balloons, that is, lower than 2,000 feet (600 meters), except when precipitation is occurring, or fog prevailing.

Ceilings low enough to interrupt airplane traffic are due almost invariably to low-lying clouds, or fog, in the higher mountain regions which obscure the mountain tops and close in the mountain passes. The most important and frequent causes limiting visibility are fogs, heavy snow, and floating frost in the air. The causes limiting visibility to a lesser extent are smoke, usually occurring in the vicinity of cities, dust storms, and occasionally blowing snow and heavy rain.

Low clouds in the Rocky Mountain region nearly always occur in connection with a low or cyclone over or in the vicinity of this region. Often ceilings are high enough for flights in the lower valleys and comparatively level plateau regions, but too low to allow flights in the mountain region.

Fogs are almost wholly a winter-time phenomenon in the Rocky Mountain region. They are nearly always of the radiation type and form most frequently in the mountain valleys and over the plateau regions. They are more frequent and extensive when the country is snow covered and an anticyclone has settled over the region. These fogs occasionally cover wide expanses of the country in the region surrounding Great Salt Lake, and sometimes continue without a break for a week or longer at a time. Their depth is usually not very great and it is often possible to fly over them.

Heavy snow, most frequently occurring in the mountain regions as snow squalls, is the next in importance to fog as an element limiting visibility. These squalls, usually local and limited in area, often set in suddenly in the mountain regions, blotting out passes and mountain sides, and are thus a serious menace to flying. They are one of the most difficult elements to deal with in airways forecasting in this region.

Frost in the air (floating frost crystals) usually occurring with fog formation, is not an infrequent occurrence in the Rocky Mountain region during periods of cold weather in winter, and sometimes materially restricts visibility. This phenomenon is often observed with a clear sky prevailing overhead, and with a temperature of 10° to 15° F. (−12° to −9° C.) or lower.

Smoke occasionally becomes dense enough during the winter months in the vicinity of the larger cities materially to restrict visibility, especially at nighttime. A mixture of fog and smoke is a quite common occurrence in the vicinity of Salt Lake City during the winter months, and occasionally becomes dense enough to prevent landings and take-offs.

Dust storms occur occasionally over the desert regions, during dry periods of summer and autumn, when high winds prevail. Dust is sometimes lifted several thousand feet in the air and occasionally becomes dense enough to obscure landing fields.

There is very little interruption to flying owing to poor ceiling and poor visibility in the Rocky Mountain region during approximately seven months of the year; that is, from May to November, inclusive. During May and November some of the higher mountain passes may be closed in by low clouds during stormy periods, but this condition seldom lasts as long as a day at a time, and probably the average occurrence is less than three times during a month. From December to April, inclusive, conditions are very unfavorable for flying approximately one-sixth of the time. The three winter months, December, January, and February, are decidedly the worst.